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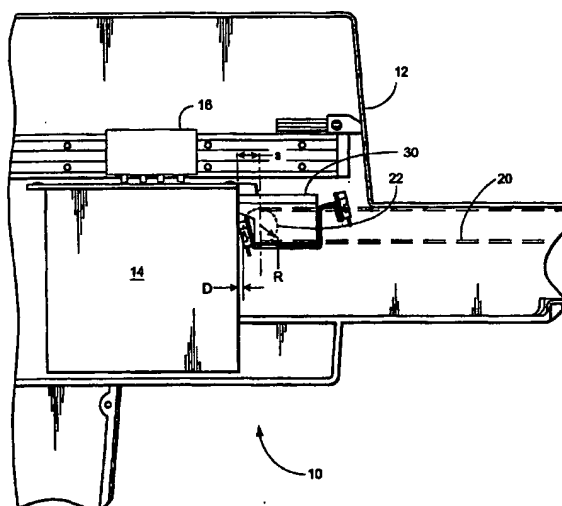
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- (74) Agent: ISHIMARU, Mikio; The Law Offices of Mikio Ishimaru, 1046 Pinenut Court, Sunnyvale, CA 94087 (US).
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- (71) Applicant: DATA I/O CORPORATION [US/US]; 10525 Willows Road, N.E., Redmond, WA 98052 (US).
- (72) Inventors: POWELL, Bryan, D.; 27442 SE 216th Street, Maple Valley, WA 98038 (US). BERNARD, Richard, Alan; 11007 29th Dr. SE, Everett, WA 98208 (US). BOLOTIN, Lev, M.; 9306 NE 125th Street, Kirkland, WA 98034 (US). JOHNSON, Bradley, Morris; 9015 242nd St. SW, Edmonds, WA 98026 (US).

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(54) Title: MICRODEVICE PROGRAMMER/FEEDER REJECT HANDLING SYSTEM



(57) Abstract: A microdevice reject handling system is provided for a microdevice processing/feeder system (10). The feeder mechanism (20) is immediately adjacent to the processing mechanism (14) for receiving and moving microdevices away from the processing mechanism. It uses a conveyor (20) which has a dead space in which microdevices cannot be placed by a robotic transport system (16), which moves microdevices from the processing mechanism (14) to the feeder mechanism (20). The microdevice reject handling system (30) is partially positioned in the feeder mechanism (20) dead space for receiving rejected microdevices. It includes a reject bin (40) with a storage portion for storing rejected microdevices beside the feeder mechanism (20) and rests on a bracket (52) containing an optical sensor system (58) for determining when the storage portion is full.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MICRODEVICE PROGRAMMER/FEEDER REJECT HANDLING SYSTEM

TECHNICAL FIELD

The present invention relates generally to handling rejected microdevices for
5 assembly lines and more particularly to handling rejected microdevices in a
programmer/feeder.

BACKGROUND ART

In the past, programmable microdevices were programmed in a large, standalone
programming system, which had a programmer handling system. The programmer handling
10 system would pick up unprogrammed microdevices, place them in the programmers for
programming, and remove them for placement on a carrier. The programmer handling
systems would also place rejected microdevices, which did not meet specifications or which
could not be programmed, into large reject bins appropriate to large programming systems.
The programmed microdevices, which were not rejected, would be placed on the carrier and
15 placed in an input feeder, which would be attached to an assembly line. The assembly line
had its own assembly line handling system which would pick up the programmed
microdevices and place them on printed circuit boards.

With the advent of the programmer/feeder where programming and feeding are
performed in a single device, space is at a premium. Since a programmer/feeder must be
20 placed on the assembly line in a space which was formerly only occupied by a feeder, it has
become extremely difficult to find space for a reject handling system.

The old concept of the standalone programming system or the newer concept of using
the assembly line handling system for placing rejected parts into a separate reject bin has
been found to be extremely time-consuming and inefficient, because of the long movements
25 required, however, heretofore there has been no other solution.

Ideally, a microdevice reject handling system would take up as little space as possible,
require short reject movements, and allow easy removal of rejected parts. This ideal has been
extremely difficult to achieve and has eluded those skilled in the art.

DISCLOSURE OF THE INVENTION

The present invention provides a microdevice reject handling system in a microdevice processing/feeder system. A robotic transport mechanism moves microdevices from the processing mechanism to the immediately adjacent feeder mechanism. The feeder
5 mechanism has a dead space in which microdevices cannot be placed by the robotic transport system. The microdevice reject handling system is partially positioned in the feeder mechanism dead space for receiving rejected microdevices from the robotic transport mechanism and storing them beside the feeder mechanism. It includes a reject bin with a storage portion for storing rejected microdevices beside the feeder mechanism and rests on a
10 bracket containing an optical sensor system for determining when the storage portion is full. This configuration allows for a microdevice reject handling system which is compact both in the lateral and depth-wise direction of the processing/feeder, requires short reject movements, and allows easy removal of rejected microdevices.

The present invention further provides a programmable microdevice reject handling
15 system in a microdevice programmer/feeder system. A robotic transport mechanism moves microdevices from the programming mechanism to the immediately adjacent conveyor feeder mechanism. The conveyor feeder mechanism has a dead space in which microdevices cannot be placed by the robotic transport system. The microdevice reject handling system is partially positioned in the conveyor feeder mechanism dead space for receiving rejected
20 microdevices from the robotic transport mechanism and storing them beside the conveyor feeder mechanism. It includes a reject bin with a storage portion for storing rejected microdevices beside the conveyor feeder mechanism and rests on a bracket containing an optical sensor system for determining when the storage portion is full. This configuration allows for a microdevice reject handling system which is compact both in the lateral and
25 depth-wise direction of the programmer/feeder, requires short reject movements, and allows easy removal of rejected microdevices.

The above and additional advantages of the present invention will become apparent to those skilled in the art from a reading of the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cutaway cross-sectional view of the programmer/feeder incorporating the present invention;

FIG. 2 is a plan view of the programmer/feeder incorporating the present invention;
5 and

FIG. 3 is an isometric view of the microdevice reject handling system of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Structure:

10 Referring now to FIG. 1, therein is shown a cutaway side view of a processing system, such as a programmer/feeder 10 incorporating the present invention. The programmer/feeder 10 includes a frame 12 containing a processing unit, or programmer 14, and a robotic transport system 16 for transferring microdevices 18 from the programmer 14 to a feeder mechanism, such as a conveyor belt 20.

15 The conveyor belt 20 has a pair of rollers, of which only one roller 22 is shown. The roller 22 has a radius R and is spaced a distance D from the programmer 14. For ease of understanding, the conveyor belt 20 and the roller 22 are shown in dotted outline. A space S represents a "dead space", which is the sum of the distance D plus the radius R , and is a space in which the robotic transport system 16 can not place microdevices 18.

20 Positioned behind the conveyor belt 20 and the roller 22 is a microdevice reject handling system 30 of the present invention.

Referring now to FIG. 2, therein is shown a cutaway plan view of the programmer/feeder 10. The programmer 14 and the conveyor belt 20 are shown to be collinear in this view and the robotic transport system 16 is shown over the programmer 14
25 and also to the back.

The microdevice reject handling system 30, in part, is shown to have a first sloped portion 32, which is disposed in the dead space S , and a second sloped portion 34, which leads to a storage portion 36. The second sloped portion 34 and the storage portion 36 are both behind the conveyor belt 20.

30 Referring now to FIG. 3, therein is shown an isometric view of a portion of the microdevice reject handling system 30. This portion includes a reject bin 40, which has the

first sloped portion 32 sloping towards the second sloped portion 34, which is partially surrounded by a backstop portion 38. This allows the direction of microdevices 18 which have been put on the first sloped portion 32 to slide into the storage portion 36. The storage portion 36 also contains an arced slide 42, which prevents accumulation of microdevices 18 just under the end of the second sloped portion 34 but allows them to spread along the length of the storage portion 36

The microdevice reject handling system 30 further includes a support system 50. The support system 50 includes a bracket 52 which is formed to accommodate send and receive optical sensor units 54 and 56 which are parts of an overflow sensor system 58. As would be evident, the reject bin 40 fits into the bracket 52 so the overflow sensor system 58 can sense microdevices which accumulate above the walls of the storage portion 36.

Operation:

In operation, the robotic transport system 16 deposits the microdevices 18 into the programmer 14 and removes them for placement on the conveyor belt 20. In order to minimize movement of the robotic transport system 16, the dead space S is made as small as possible as indicated in FIGs 1 and 2.

Because of the use of the conveyor belt 20, there is a dead zone equal to the distance D plus the radius R of the roller 22 in which a microdevice 18 cannot be placed without falling off of the conveyor belt 20. The first sloped portion 32 of the reject bin 40 is designed to have a width less than the dead space S so as to be smaller than the distance D plus the radius R.

Thus, it is possible for the robotic transport system 16 to take a rejected microdevice 18 and release it onto the first sloped portion 32 of the reject bin 40 of FIG. 2. The deposited rejected microdevice 18 would slide back down the first sloped portion 32 where the backward motion would be stopped by the backstop portion 38. Because of the second sloped portion 34, the microdevice 18 would be directed into the storage portion 36 of the reject bin 40.

The second sloped portion 34 is required so that there will be room for the overflow sensor system 58 between the programmer 14 and the bracket 52 of the reject handling system 30. The send and receive optical sensors units 54 and 56 are conventional sensors which indicate when the storage portion 36 is filled with rejected microdevices 18 so the operator will know to remove and empty the reject bin 40.

One feature of the present invention is that the first sloped portion 32 may be used as a handle to lift the reject bin 40 over the top of the conveyor belt 20 for emptying. It is desirable for the reject handling system 30 to be behind the conveyor belt 20 so as to make the front-to-back depth of the programmer/feeder 10 as small as possible.

5 From the above it will be understood that the present invention is applicable to what can be described as "microdevices". Microdevices include a broad range of electronic and mechanical devices. The best mode describes processing which is programming for programmable devices, which include but are not limited to devices such as Flash memories (Flash), electrically erasable programmable read only memories (E²PROM), programmable
10 logic devices (PLDs), field programmable gate arrays (FPGAs), and microcontrollers. However, the present invention encompasses processing for all electronic, mechanical, hybrid, and other devices which require testing, measurement of device characteristics, calibration, and other processing operations. For example, these types of microdevices would include but not be limited to devices such as microprocessors, integrated circuits (ICs),
15 application specific integrated circuits (ASICs), micro mechanical machines, micro-electro-mechanical (MEMs) devices, micro modules, and fluidic systems.

While the invention has been described in conjunction with a specific best mode, it is to be understood that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to
20 embrace all such alternatives, modifications, and variations which fall within the spirit and scope of the included claims. All matters set forth herein or shown in the accompanying drawings are to be interpreted in an illustrative and non-limiting sense.

THE INVENTION CLAIMED IS:

1. A microdevice processing/feeder system comprising:
a processing mechanism [14] for processing microdevices;
a feeder mechanism [20] adjacent to the processing mechanism [14] for receiving and
5 moving microdevices away from the processing mechanism [14], the feeder
mechanism [20] having a dead space provided thereon in which microdevices
cannot be placed;
a robotic transport system [16] for moving microdevices from the processing
mechanism [14] and placing microdevices on the feeder mechanism [20];
10 a microdevice reject system [30] disposed in the feeder mechanism [20] dead space
for receiving rejected microdevices, the microdevice reject system [30]
including a reject bin [40] configured to receive rejected microdevices from
the robotic transport system [16] in the feeder mechanism [20] dead space, the
reject bin [40] including a storage portion for storing rejected microdevices
15 beside the feeder mechanism [20].
2. The microdevice processing/feeder system as claimed in claim 1 including a
sensor system [58] disposed proximate the storage portion of the reject bin [40] for providing
an indication when the reject bin [40] is filled with microdevices.
3. The microdevice processing/feeder system as claimed in claim 2 wherein:
20 the microdevice reject system [30] includes a bracket [52] for supporting the reject bin
[40]; and
the bracket [52] has the sensor system [58] mounted thereon.
4. The microdevice processing/feeder system as claimed in claim 3 wherein the
reject bin [40] has a first sloped portion for moving rejected microdevices from the feeder
25 mechanism [20] dead space, and a second sloped portion for moving rejected microdevices
perpendicularly from the first sloped portion to the storage portion.
5. The microdevice processing/feeder system as claimed in claim 4 wherein the
reject bin [40] is configured to allow removal thereof from the bracket [52] and the sensor
system [58].
- 30 6. A microdevice reject handling system for a processing/feeder system [10]
having a processing mechanism [14] for processing microdevices, a feeder mechanism [20]
adjacent to the processing mechanism [14] for receiving and moving microdevices away from

the processing mechanism [14], the feeder mechanism [20] having a dead space thereon in which microdevices cannot be placed, comprising:

- a robotic transport system [16] for moving microdevices from the processing mechanism [14] and placing microdevices on the feeder mechanism [20];
- 5 a microdevice reject system [30] disposed in the feeder mechanism [20] dead space for receiving rejected microdevices, the microdevice reject system [30] including a reject bin [40] configured to receive rejected microdevices from the robotic transport system [16] in the feeder mechanism [20] dead space, the reject bin [40] including a storage portion for storing rejected microdevices
- 10 beside the feeder mechanism [20].

7. The microdevice reject handling system as claimed in claim 6 including a sensor system [58] disposed proximate the storage portion of the reject bin [40] for providing an indication when the reject bin [40] is filled with microdevices.

- 8. The microdevice reject handling system as claimed in claim 7 wherein:
- 15 the microdevice reject system [30] includes a bracket [52] for supporting the reject bin [40]; and
- the bracket [52] has the sensor system [58] mounted thereon.

- 9. The microdevice reject handling system as claimed in claim 8 wherein the reject bin [40] has a first sloped portion for moving rejected microdevices from the feeder
- 20 mechanism [20] dead space, and a second sloped portion for moving rejected microdevices perpendicularly from the first sloped portion to the storage portion.

- 10. The microdevice reject handling system as claimed in claim 9 wherein the reject bin [40] is configured to allow removal thereof from the bracket [52] and the sensor system [58].

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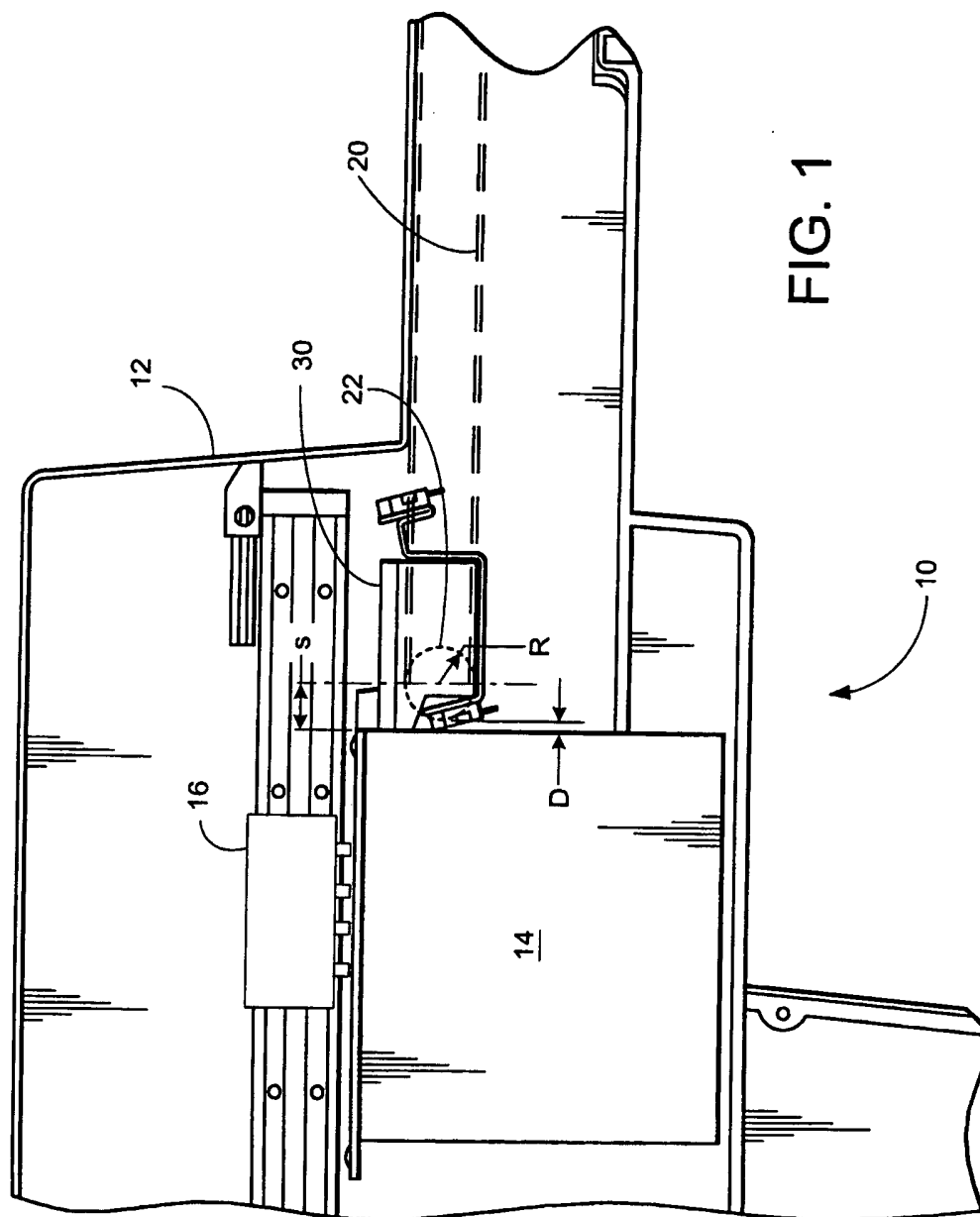


FIG. 1

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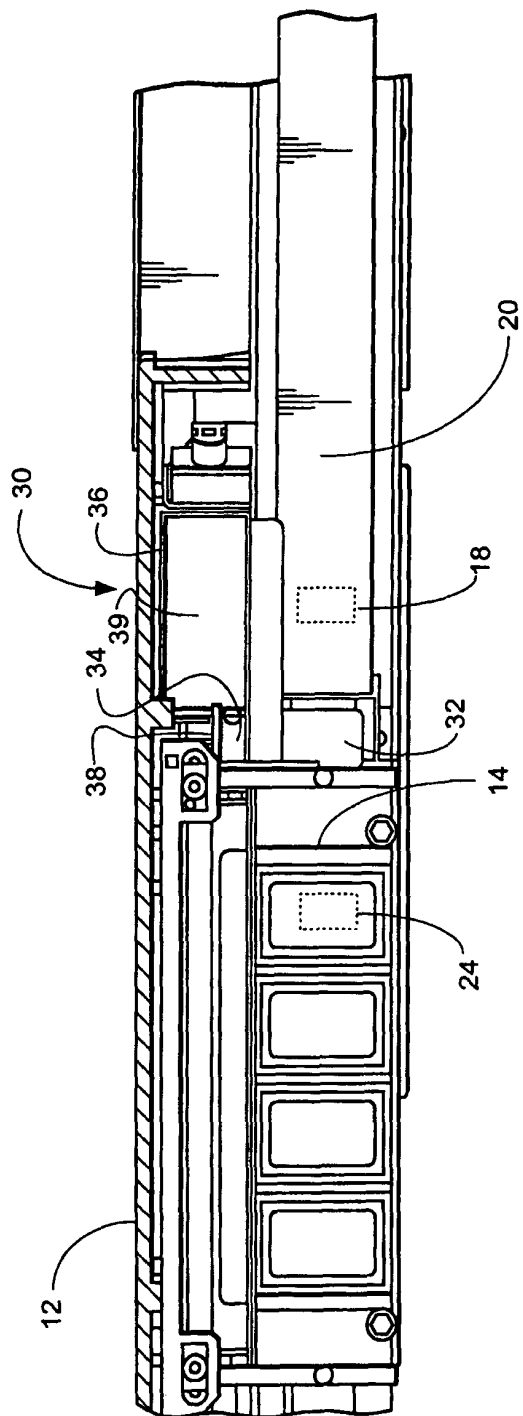


FIG. 2

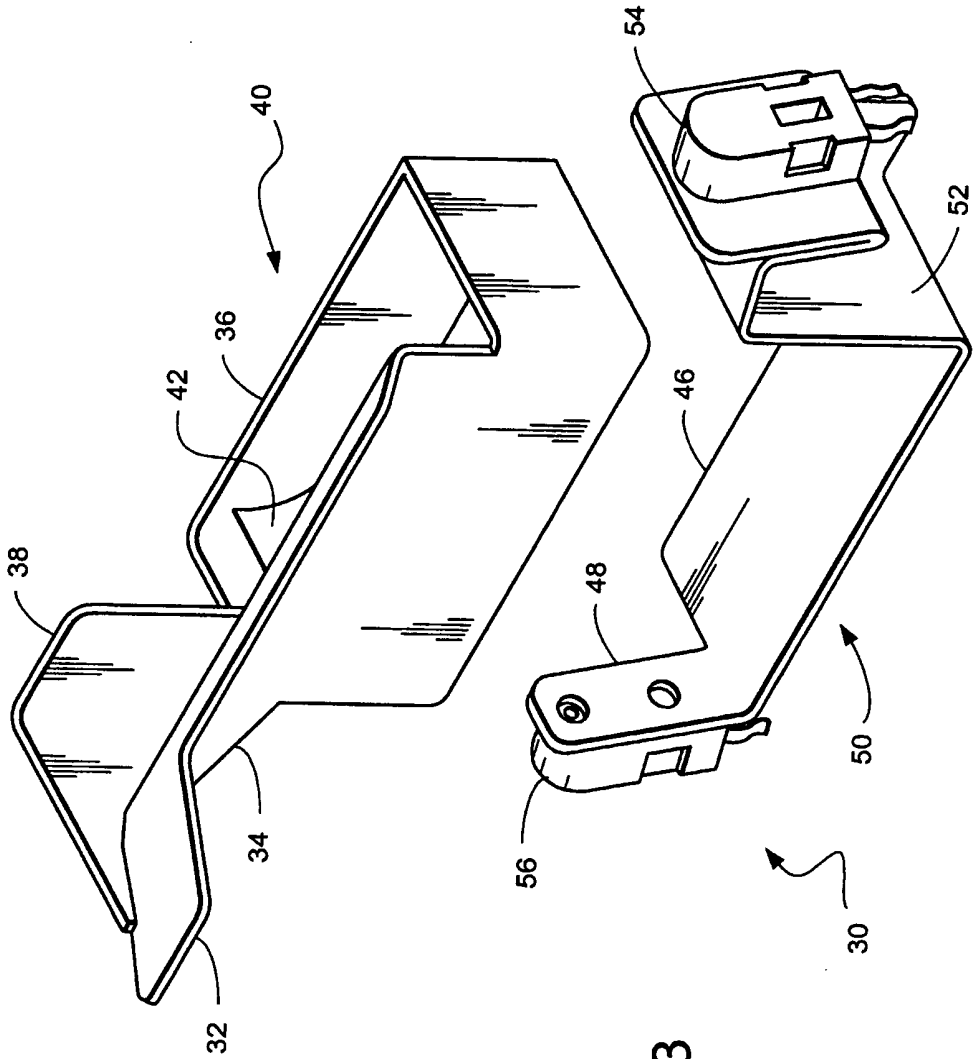


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/02062

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H05K13/02 H05K13/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H05K G01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 196 12 713 A (SIEMENS AG) 2 October 1997 (1997-10-02) claims; figures ---	1
A	EP 0 517 439 A (AMERICAN TELEPHONE & TELEGRAPH) 9 December 1992 (1992-12-09) column 8, line 44 -column 9, line 43; figures -----	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
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- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

9 May 2001

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Rieutort, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/02062

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